12. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, wherein the discharge vessel consists of an UV transparent material and is filled with a filling gas emitting UV.

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13. (Once Amended) A device for the backlighting of a liquid crystal display, including at least one low-pressure gas discharge lamp with a discharge vessel , at least two capacitive coupling-in structures, operating at an operating frequency f, as the light source, and an optical system for producing backlighting, wherein each capacitive coupling-in structure consists of at least one dielectric having a thickness d and a dielectric constant ε, each dielectric being subject to the condition $d/(f.\varepsilon) < 10^{-8}$ cm.

REMARKS

This application has been reviewed in light of the Office Action mailed on September 5, 2002. Claims 1-13 are pending in the application with Claims 1 and 13 being in independent form. By means of the present amendment, the specification and claims have been amended to place them in better form, such as adding headings to the specification in accordance with 37 CRF 1.77(b) and deleting references in the claims as well as changing "characterized in that" to –wherein –. The above amendments are submitted to place this application in proper U.S. format. Accordingly, Applicant respectfully requests that these grounds for objection be withdrawn.

In the Office Action, the Examiner rejected Claims 1-13 under 35 U.S.C. 112, second paragraph as being indefinite due to the term "cm.s." in Claims 1, 2 and 13. In response, Claims 1, 2 and 13 have been amended to correct this term. Accordingly, withdrawal of this objection is respectfully requested.

Claims 1-13, were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,801,482 issued to Verhaar et al. Applicants respectfully traverse this rejection, however, Claims 1-13 have been amended in a manner that does not materially alter the scope thereof in order to clarify and improve their form. Applicants respectfully submit that Claims 1-13 are patentable over Verhaar et al. for at least the reasons stated below.

The Examiner asserts in the Office Action that Verhaar et al. discloses, inter alia, two-spatially separated capacitive coupling-in structure/end portions [abstract, line 3] and operates at an operating frequency, and each capacitive coupling-in structure is formed by at least one dialectric [Figure 1, column 3, lines 29-38]. The Examiner further states that Verhaar et al. discloses the claimed invention except for wherein each dielectric being subject to a specific condition. From a review of the reference, it is respectfully submitted that Verhaar et al. does not even teach or suggest the particular spatially separated capacitive coupling-in structure/end portions of Claims 1 and 13. Verhaar et al. merely shows a first and second end portion. The Examiner refers to the abstract at line 3 which states:

> A low-pressure mercury vapor discharge lamp according to
> The invention is provided with a discharge vessel having a
> Tubular portion and <u>first and second end portion</u>. The
> Discharge vessel encloses a discharge space provided with a... [Emphasis
> Added]

There is no teaching or suggestion of two-spatially separated capacitive coupling-in structure/end portions in the Abstract,.

The Examiner also cites Verhaar at FIG. 1 and Col. 3 lines 29-38 in support of his assertion. Verhaar at Col. 3, lines 29-38 states:

FIG. 1 shows a low pressure mercury vapor discharge Lamp provided with a gas discharge vessel 10 having a tubular portion 11 which transmits radiation generated in the Discharge vessel 10 and having a first and a second end Portion 12a, 12b. The tubular portion 11 has a length of 120 cm and an internal diameter of 2.5 cm. The discharge vessel 10 encloses a discharge space 13 provided with a filling of 1mg mercury and a rare gas, here argon, in gastight manner. The end portions 12a, 12b each support an electrode 20b (the electrode at the first end portion 12a is not shown) arranged in the discharge space 13. Current supply conduc-

There is no teaching or suggestion of two-spatially separated capacitive coupling-in structure/end portions in the disclosure of Verhaar et al. at Col. 3, lines 29-38, merely the recitation of first and second end portions 12a, 12b.

While Verhaar et al. shows first and second end portions, these end portions 12a, 12b support conventional metallic electrodes.

Applicant's two-spatially separated capacitive coupling-in structure/end portions are used, as recited by Claims 1 and 13, as electrodes in a capacitive mode of operation to achieve higher operating efficiency in conjunction with a small structural volume, a high luminous flux, a low operating voltage, a low electromagnetic radiation, a high resistance against switching transients and a long service life. Known capacitive discharge lamps have the disadvantage that for an operating frequency > 1 MHz, the high operating frequency causes, in conjunction with a high current density in the lamp, strong electromagnetic radiation, which requires elaborate steps throughout the system formed by the lamp, reflector, drive electronics, etc. in order to limit the electromagnetic radiation.

Because the power is capacitively coupled in via the discharge vessel, the operating frequency is limited downwards (to approximately 1 MHz) via the capacitance of the coupling-in surface.

The specification discloses a capacitive discharge lamp provided with a dielectric layer between external electrodes and the gas discharge. An alternating current source outputs a voltage from 500V to 10,000V at a frequency of 120 Hz. The dielectric layer has a high dielectric constant which is greater than 100, preferably greater than 2000. The capacitive coupling in of the external alternating voltage by means of the dielectric layer causes ionization and excitation of the gas in the lamp, so that luminous gas discharge occurs. The combination of dielectric constant and operating frequency is capable of achieving a high luminous flux of the lamp, only by using coupling in structures of very large dimensions so that the lamp overall will also be of large dimensions. Moreover, in such a lamp a high luminous flux requires an extremely high operating voltage and hence an expensive drive circuit. The recited drawbacks are unacceptable for use in a device for backlighting.

In particular, only after undue experimentation did Applicants realize that a low-pressure mercury discharge lamp can be constructed using two-spatially separated capacitive coupling-in structure/end portions to achieve higher operating efficiency in conjunction with a small structural volume, a high luminous flux, a low operating voltage, a low electromagnetic radiation, a high resistance against switching transients and a long service life. The lamp according to the invention overcomes the drawbacks of known lamps notably for operation in the frequency range from 150 Hz to 1 MHz. Applicants realized that such a gas discharge lamp is possible by using a dielectric material having an

essentially negative temperature dependency. During operation of the lamp, the dielectric is heated due to the coupling-in of power, so that the dielectric capacitance decreases and the maximum power that can be coupled in is limited, as will be described below. Appicants realized that even though the dielectric capacitance decreases with increased temperature, the condition $d/(\epsilon .f) < 10\text{-}^{8}$ continues to be satisfied.

When the temperature of the dielectric material during the operation of the lamp reaches a value at which the drop of the dielectric constant occurs as the temperature increases, this behavior contributes to the stabilization of the power of the lamp. More particularly, when a suitable thermal bond is formed between the lamp holder and the ceramic, a ceramic temperature of more than 130 degrees Celsius can be realized during stationary operation of the lamp. At this temperature the dielectric constant ϵ fluctuates around very large values of approximately 5000. When the temperature of the dielectric increases further due to the coupling-in of power, the essentially negative temperature coefficient of the dielectric material causes a strong drop of the dielectric constant. As a result, the dielectric capacitance of the coupling-in structure decreases, so that a higher voltage drops across the dielectric and a smaller current flows. Less power can then be coupled into the discharge vessel, leading to a reduction in the temperature of the dielectric. This negative feedback leads to enhanced stabilization and ballasting of the lamp in the stationary mode of operation. Accordingly, Applicants' invention as recited by Claims 1 and 13 required undue experimentation to achieve the above-noted unexpected results. One having ordinary skill in the art would not have realized Applicants' invention as recited by Claims 1 and 13 by only rading Veerhar et al.

Accordingly withdrawal of the rejection under 35 U.S.C. §103(a) with respect to Claims 1 and 13 and allowance thereof are respectfully requested.

Additionally, Claims 2-12 depend from independent Claim 1 and therefore contain the limitations of Claim 1. Hence, for at least the same reasons given for Claim 1, Claims 2-12 are believed to be allowable over Veerhar et al. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) with respect to Claims 2-12 and allowance thereof are respectfully requested.

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1-13 are believed to be in condition for allowance and patentably distinguishable over the art of record.

Attached hereto and identified as VERSION AS AMENDED TO SHOW CHANGES MADE is a copy of text of Claims 1-13 detailing the amendments made thereto.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call Dico Halajian, Esq., Intellectual Property Counsel, Philips Electronics North America Corp., at 914-333-9607.

Respectfully submitted,

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VERSION AS AMENDED TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend Claims 1-13 as set forth hereinbelow:

1. (Once Amended) A low-pressure gas discharge lamp which includes a discharge vessel ~~(1)~~ and at least two spatially separated capacitive coupling-in structures ~~(2)~~ and operates at an operating frequency f,

~~characterized in that~~ wherein

each capacitive coupling-in structure ~~(2)~~ is formed by at least one dielectric having a thickness d and a dielectric constant ε, each dielectric being subject to the condition $d/(f.\varepsilon) < 10^{-8}$ cm~~.s~~.

2. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1,

~~characterized in that~~ wherein

at least one dielectric is subject to the condition $d/(f.\varepsilon) > 10^{-9}$ cm~~.s~~.

3. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1,

~~characterized in that~~ wherein

the operating frequency f is in the range of from 150 Hz to 1 MHz.

4. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1,

~~characterized in that~~ wherein

the dielectric constant of the dielectric has an essentially negative temperature dependency.

5. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1,

~~characterized in that~~ wherein

the discharge vessel ~~(1)~~ is shaped essentially as a hollow cylinder having an inside diameter d_i which is smaller than 10 mm.

6. (Once Amended) A low- pressure gas discharge lamp as claimed in claim 5, ~~characterized in that~~ wherein

the capacitive coupling-in structure ~~(2)~~ is shaped essentially as a hollow cylinder, has an inside diameter d_i and is connected to the discharge vessel ~~(1)~~ in a compression proof manner.

7. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, ~~characterized in that~~ wherein

the discharge vessel ~~(1)~~ is filled with a filling gas containing at least one inert gas.

8. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 7, ~~characterized in that~~ wherein

the filling gas contains mercury.

9. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, ~~characterized in that~~ wherein

the operating frequency f is less than 150 kHz.

10. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, ~~characterized in that~~ wherein

the discharge current of the gas discharge is more than 10 mA.

11. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, ~~characterized in that~~ wherein

the dielectric consists of a paraelectric, ferroelectric or anti-ferroelectric solid material.

12. (Once Amended) A low-pressure gas discharge lamp as claimed in claim 1, ~~characterized in that~~ wherein

the discharge vessel ~~(1)~~ consists of an UV transparent material and is filled with a filling gas emitting UV.

13. (Once Amended) A device for the backlighting of a liquid crystal display, including at least one low-pressure gas discharge lamp with a discharge vessel ~~(1)~~, at least two capacitive coupling-in structures ~~(2)~~, operating at an operating frequency f, as the light source ~~(10)~~, and an optical system ~~(13, 14, 15)~~ for producing backlighting, ~~characterized in that~~ wherein

each capacitive coupling-in structure ~~(2)~~ consists of at least one dielectric having a thickness d and a dielectric constant ε, each dielectric being subject to the condition $d/(f.\varepsilon) < 10^{-8}$ cm~~.s~~.